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Department of Water Resources

BULLETIN No. 105-1

DEVELOPING THE NORTH COAST

An Action Program

Progress Report

FEB 9 1967

DECEMBER 1966

HUGO FISHER
Administrator
The Resources Agency

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources

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FOREWORD

This report outlines current knowledge of local water problems and suggests possible solutions in portions of California's North Coastal area.

The studies were begun in response to Assembly Concurrent Resolution No. 27, adopted by the Senate and the Assembly in the 1966 First Extra Session. The resolution requests that the Department of Water Resources expend $20,000 "... for an action program of investigation to enable the Department to present to the Legislature for review specific recommendations as to all necessary local, as well as other, flood control and water conservation and development facilities, primarily on the Smith, Mad, and Van Duzen Rivers and the South Fork of the Eel River, which the Department determines must be constructed to accomplish overall basin development of such rivers..."

This report includes a preliminary evaluation of local problems and specific plans for the solution of these problems. It also describes a proposed future program to evaluate in detail these plans and similar plans in other basins in the North Coastal area.

This report shows the need for future studies of local projects and estimates the funding required to meet this need. The last chapter summarizes the funding schedule required and recommends that the Legislature approve this schedule.

Neely Gardner

Neely Gardner, Acting Director
for William E. Warne, Director
Department of Water Resources
The Resources Agency
State of California

December 27, 1966

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State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

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AUTHORIZATION

Assembly Concurrent Resolution No. 27 - Relative to the north coastal area investigation.

WHEREAS, The recent disastrous floods in the north coastal area have demonstrated the urgent need for the construction of flood control works and water conservation and development facilities; and

WHEREAS, The rivers involved, which are now largely unharnessed, are a source of water to meet both local and other needs; and

WHEREAS, It is essential that an action program which will bring about overall basin development of these rivers at the earliest possible time be undertaken by the Department of Water Resources; now, therefore, be it

Resolved by the Assembly of the State of California, the Senate thereof concurring, That the Department of Water Resources is hereby requested to expend twenty thousand dollars ($20,000) of the money appropriated and budgeted for expenditure for the north coastal area investigation for an action program of investigation to enable the department to present to the Legislature for review specific recommendations as to all necessary local, as well as other, flood control and water conservation and development facilities, primarily on the Smith, Mad, and Van Duzen Rivers and the South Fork of the Eel River, which the department determines must be constructed to accomplish overall basin development of such rivers, taking into full consideration the necessity for flood control, the preservation and enhancement of fish and wildlife, and all other evaluations as pertain to the preservation and enhancement of other natural resources in the basins; and be it further

Resolved, That the Chief Clerk of the Assembly will transmit a copy of this resolution to the Director of Water Resources.

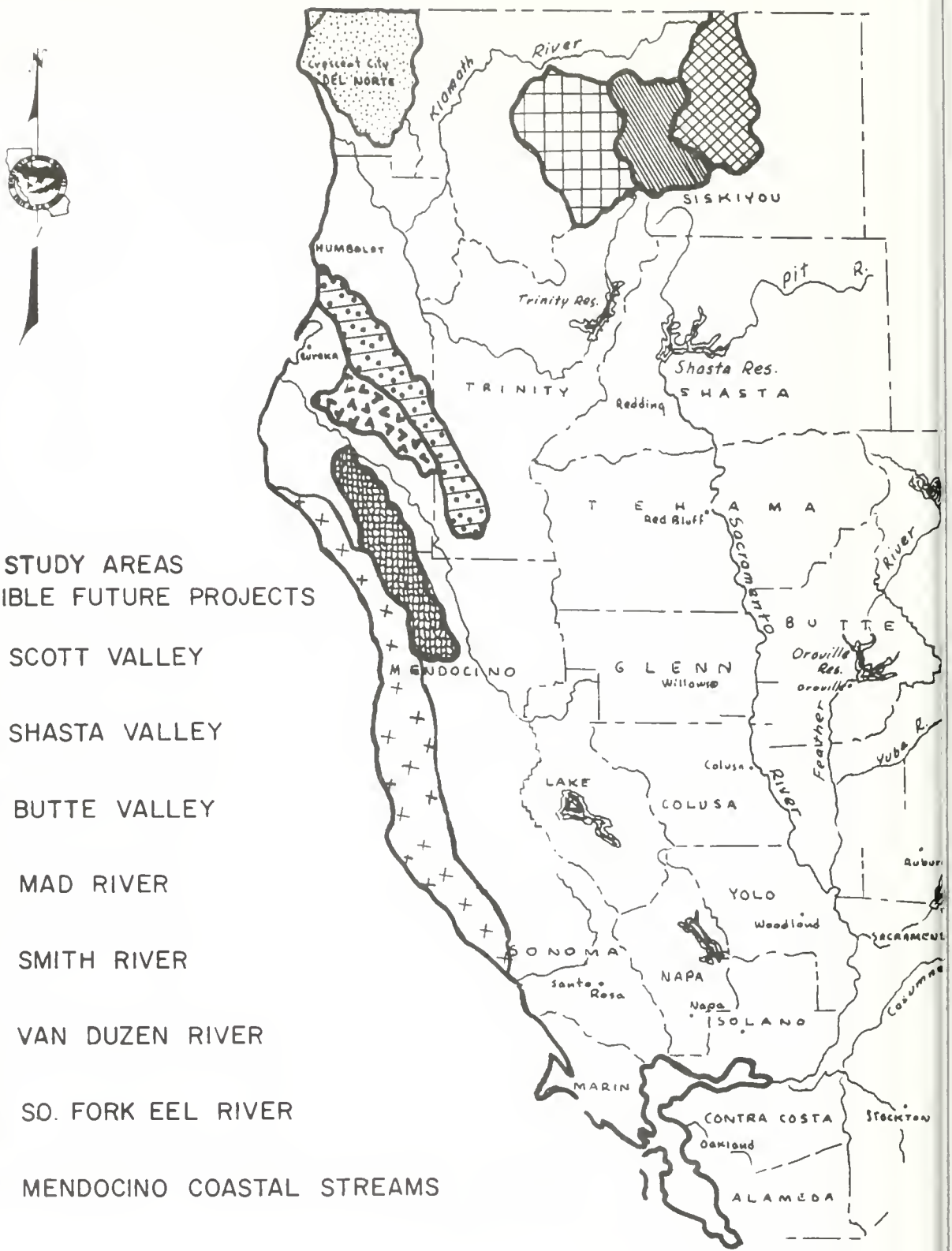
CHAPTER I. INTRODUCTION

The future of California's North Coast depends largely on the further development of its natural resources, particularly its abundant water resource. Previous planning for water resources development in the North Coastal area has been primarily concerned with major projects, with emphasis on possible export. There is a need for more emphasis on the smaller-scale, local projects, and identification of the more desirable of these for possible acceleration to benefit the lagging economy.

During the past century, the North Coastal area of California was developed through utilization of its natural resources, first by mining gold in the Trinity and Klamath Rivers watersheds, and next by cutting redwood, fir, and pine timber from extensive forests covering Mendocino, Humboldt, Trinity, Del Norte, and Siskiyou Counties. The ocean and streams of the North Coast have provided important commercial and sport fisheries as long as man has been in the area. The newest development in the North Coastal area is the seasonal influx of tourists seeking recreation and refreshment in this region of scenic beauty and pleasant climate.

However, each of these economies has been subjected to retarding forces and has not been able to contribute fully to a bountiful economy in recent years. Gold mining stopped during World War II and never started again. The lumber industry reached its peak some years ago and is expected to gradually decline to a point at which the timber resource is harvested on a sustained yield basis and with the volume and level of employment somewhat less than today. Recreation continues to grow but suffers from loss of good fishing in the streams and from loss of facilities damaged in recent floods. The water resources of the North Coastal area are extremely important to the future of California. The bulk of the State's future water needs may be supplied from this area. In virtually all major schemes involving transfers of water among major river basins in California and in many proposed western regional interstate transfers, the large undeveloped water supplies of California's North Coastal region are

Figure 1



STUDY AREAS
FOR POSSIBLE FUTURE PROJECTS

- SCOTT VALLEY
- SHASTA VALLEY
- BUTTE VALLEY
- MAD RIVER
- SMITH RIVER
- VAN DUZEN RIVER
- SO. FORK EEL RIVER
- MENDOCINO COASTAL STREAMS

NORTH COASTAL ACTION PROGRAM

VICINITY MAP

included. Yet, paradoxically there is a pressing need for development of additional water supplies for use within this area of apparent surplus. Local water requirements, in portions of this area, have already exceeded summer stream flows, while devastating winter floods destroy life and property.

The coastal area north of the Mad River (McKinleyville to Big Lagoon) has an immediate need for new and better domestic water supplies. Water was rationed in this area in 1966, and current supplies often fall short of desirable water quality standards. Representatives of the Department's Northern District and local officials and citizens have taken positive steps toward possible solutions to these problems.

The Crescent City-Smith River coastal plain is confronted with two current water problems. The City is subjected to localized flooding from Elk Creek. Del Norte County has a flood control problem at Lakes Earl and Talawa. If residential developments around these lakes proceed as planned, serious water pollution would probably result. And, of course, the flood problem would be compounded. The Northern District has discussed these problems with Del Norte County officials, and they consider the Lake Earl problems, present and potential, to be among the major water problems in the county.

Reservoirs in the Van Duzen and South Fork Eel River Basins could provide for anticipated supplemental future water requirements in these basins and in the lower Eel River Delta. These projects would also create significant new recreation opportunities.

A large pulp mill probably will be constructed on the Mendocino Coast near Fort Bragg by 1990. If this mill is developed, it will create a spectacular increase in municipal and industrial water requirements for this area. In addition, the Anderson Valley area of Mendocino County has a large potential for growth of agricultural water requirements. The Department's San Francisco Bay District has already begun studies of projects to satisfy these possible future water requirements.

The Area of Investigation

The North Coastal area includes the drainage basins of all the streams flowing into the Pacific Ocean between the Russian River and the Oregon State line. Major streams included are the Smith River, the Klamath River (including its major tributaries, the Shasta, Scott, Salmon, and Trinity Rivers), the Mad River, the Eel River (including the Van Duzen), and the Russian River. Minor streams included are Redwood Creek, and the Mattole, Noyo, Big, Navarro, Garcia, and Gualala Rivers.

Most of the area is mountainous and well covered with timber. With the exception of Scott, Shasta, and Butte Valleys and the Tule Lake area, there are only a few mountain valleys with significant amounts of irrigable agricultural land. Other areas of potential agricultural importance are located along the coast on river deltas and coastal plains.

Climatically the region is characterized by distinct temperature zones--moderate and foggy much of the year along the coast, with a wider seasonal variation in the inland areas. The area has more annual precipitation than any other area in California. It is distinctly seasonal, however, and results in the more southerly streams of the region producing large runoff during winter months and yet becoming little more than a series of pools in the late summer.

Development

In an effort to obtain a picture of present development in the North Coastal area, a statistical profile has been compiled comparing the study area with the State as a whole. Three primary categories have been used: population, personal income, and employment. Three counties have been selected as representative - Del Norte, Humboldt, and Mendocino.

Population

Table 1 shows the historical population growth for the three counties and for the entire State. The major population centers in these counties are Crescent City, Eureka, Fort Bragg, Ukiah, and Willets. The figures in Table 1 show that from 1900 to 1940 these counties experienced a much lower population growth rate than the State as a whole, but from

1940 to 1960 had a growth rate almost identical to the State. There is some evidence that since 1960 these counties have again fallen behind the State in population growth rate. This slowdown is closely tied to the lumber industry.

TABLE 1

HISTORICAL POPULATION

CALIFORNIA AND THE NORTH COAST
1900 - 1960

County	1900	1910	1920	1930	1940	1950	1960
l Norte	2,408	2,417	2,759	4,739	4,745	8,078	17,771
umboldt	27,104	33,857	37,413	43,233	45,812	69,241	104,892
ndocino	20,465	23,929	24,116	23,505	27,864	40,854	51,059
TAL	49,968	60,203	64,268	71,477	78,421	118,173	173,722
crease ring cade (%)	---	20%	7%	11%	10%	51%	47%
ate Total	1,485,053	2,377,549	3,426,861	5,677,251	6,907,387	10,586,223	15,717,204
crease ring cade (%)	---	60%	44%	66%	22%	53%	49%

Income

Personal income for the three North Coast counties has increased from about 50 million dollars in 1940 to about 380 million dollars in 1960, remaining close to one percent of the State's total during this period (see Table 2). On a per capita basis, personal income is considerably less than the state average (see Table 3). Since 1950, both per capita income and total income of the area have declined somewhat in relation to the state average.

TABLE 2

PERSONAL INCOME

CALIFORNIA AND THE NORTH COAST
1940 - 1960

	1940	1950	1960
Del Norte	$ 2,437,000	$ 14,706,000	$ 36,884,000
Humboldt	32,663,000	126,258,000	238,793,000
Mendocino	16,931,000	61,379,000	101,849,000
TOTAL	$52,031,000	$202,343,000	$377,526,000
State	$5,839,000,000	$19,627,000,000	$43,183,000
Percent North Coast to State	0.88%	1.03%	0.87%

TABLE 3

PER CAPITA INCOME

CALIFORNIA AND THE NORTH COAST
1940 - 1960

	1940	1950	1960
Del Norte	$513	$1,820	$2,075
Humboldt	712	1,823	2,276
Mendocino	607	1,502	1,994
AVERAGE	$663	$1,712	$2,173
State Average	$845	$1,854	$2,747
Percent North Coast to State	78%	92%	79%

Employment

The largest employer in the North Coastal area is the lumber industry. In 1960, lumber and wood products manufacturing accounted for 28 percent* of all employment and 85 percent* of manufacturing employment. Next in importance came wholesale and retail trade at 18 percent*, followed by the service industries at 15 percent*.

Employment statistics directly related to recreation are not available. However, the impact of recreation on the economy of the area is much more significant than an employment figure would indicate. Dollars expended by recreationists, particularly tourists, add considerable income to the area and influence employment in the retail trades and service industries.

Agriculture, including food processing, supports 7 percent* of the total employment. This percentage has been declining over the last decade and will probably continue to do so. There is little good agricultural land in the area, and where it does exist it is subject to urban encroachment.

The dependence of the local economy on lumbering, and to an increasing extent on recreation, causes serious seasonal fluctuations in employment (Table 4).

The Need for Water Development

The North Coastal area is plagued by too much water in the winter and not enough water in the summer. The area has been economically stationary since about 1960, while the remainder of the State has been developing rapidly. Since 1960, lumbering, the area's major industry, has begun to decline. It is expected to do so until a sustained yield is reached, probably around 1975. There is a need for economic stimulation to offset this decline in the lumber industry. There are many things that could help provide this stimulation:

Improved transportation facilities
Diversification of recreational opportunities

* Del Norte, Humboldt, Mendocino, Trinity, and Lake Counties.

New industries

Diversification within the lumber industry

Improved fishery, sport and commercial

Flood control and flood plain management

New water supplies

Improved port facilities

While water development is not the cure-all for the North Coast's sagging economy, it could directly provide several of the factors listed above and could indirectly influence some others. The following sections outline specific areas of need for water development projects.

TABLE 4

UNEMPLOYMENT IN NORTH COAST COUNTIES
1959 - 1962

County	1959	1960	1961	1962
Del Norte				
Labor Force	6,600	7,000	6,800	6,500
Average Employment	6,200	6,200	5,900	5,900
Average Unemployment Rate	6.1%	10.0%	13.2%	9.2%
High Month Unemployment Rate	13.1%	21.1%	23.2%	15.9%
Humboldt				
Labor Force	39,800	40,400	39,600	40,200
Average Employment	37,700	37,000	35,600	36,900
Average Unemployment Rate	5.2%	8.4%	10.2%	8.2%
High Month Unemployment Rate	9.1%	16.0%	20.6%	14.2%
Mendocino				
Labor Force	18,300	17,900	17,600	17,300
Average Employment	17,200	16,300	15,800	15,700
Average Unemployment Rate	6.0%	9.5%	10.2%	9.2%
High Month Unemployment Rate	11.7%	16.6%	20.0%	17.7%

Flood Control

The need for flood control in the North Coastal area is illustrated by the massive impact of the floods of 1955 and 1964. Some of the scars -- such as those at Klamath, Pepperwood, and Weott -- will remain for generations.

The flood of December 1964 was the greatest and most devastating ever experienced in most of the North Coastal area. Flood damage estimates from the 1964 floods are summarized by county in Table 5.

Other great floods occurred in 1861, 1907, 1938, 1950, and 1955. There is every reason to believe that storms similar to the ones that caused these floods will occur again in the future.

The lack of adequate flood protection could prevent future economic development of some areas. Other areas may continue to develop in spite of the lack of flood protection and thereby suffer even greater flood damages in the future.

TABLE 5

FLOOD DAMAGES IN THE NORTH COASTAL AREA 1/
DECEMBER 1964 FLOOD

County	State Highways	Total State Highways County Roads & Bridges	Total Public Damage 2/	Private Damage	Total Private & Public Damage
Del Norte	$ 4,600,000	$ 7,275,000	$ 9,875,000	$ 8,000,000	$17,875,000
Siskiyou	5,850,000	9,303,000	9,303,000	6,700,000	16,283,000
Humboldt	14,150,000	26,500,000	30,650,000	23,000,000	57,500,000
Trinity	1,740,000	4,415,000	4,415,000	1,700,000	6,215,000
Mendocino	3,600,000	11,350,000	11,850,000	3,300,000	15,150,000
Sonoma		566,000	566,000	6,200,000	6,366,000

1/ Figures taken from Department of Water Resources Bulletin No. 161, "Flood! December 1964 - January 1965", January 1965
2/ Includes damage to state and local highways.

Water Conservation

Although the North Coastal area has an abundant annual rainfall, seasonal variation reduces streamflow to a trickle in the summer in many of the North Coastal streams. This makes storage necessary for many North Coastal areas. In some cases, diversion of natural flows has been detrimental to fish by further reducing the already low summer flows.

Most local water supplies in the North Coastal area are provided by either small reservoirs or ground water development. A notable exception is the Humboldt Bay Municipal Water District which owns and operates Ruth Reservoir (storage capacity 51,800 acre-feet) on the Mad River.

Ground water exists in nearly all the small valleys and coastal plains of the North Coast; in fact, in certain local areas, ground water furnishes most of the present supply. However, in most areas, there is insufficient ground water storage capacity to support long-range water requirements. Consequently, most areas must ultimately look to surface water development to meet their future needs.

Projected water requirements for most of the area under discussion are summarized in Table 6.

TABLE 6

SUMMARY OF PROJECTED FUTURE WATER REQUIREMENTS

Net use in 1000 acre-feet

Hydrographic Units and Stream Basins	1960	1990	2020
Trinity River	6.9	22.0	27.4
Mad River - Redwood Creek			
Mad River Basin	5.2	38.6	59.0
Redwood Creek Basin	0.8	2.1	2.5
Big Lagoon Subunit	0.3	2.0	4.3
Little River Subunit	0.4	1.3	1.9
Hydrographic Unit Subtotal	6.7	44.0	67.7
Eel River			
Eel River Basin	28.4	88.8	138.0
Eureka Plain Subunit	12.0	82.3	124.3
Cape Mendocino Subunit	1.3	4.6	8.1
Hydrographic Unit Subtotal	41.7	175.7	270.4

Typically, the smaller communities in the area barely manage to stay ahead of their water needs. Among the several areas currently considering expansion of their present facilities are Crescent City, Trinidad, McKinleyville, Manila, Willow Creek, and Yreka. The most acute problem known exists in the coastal strip from McKinleyville north to Trinidad, where rationing was necessary in the summer and fall of 1966.

Recreation

The California Public Outdoor Recreation Plan, published in 1960, concluded that the demand for outdoor recreation areas and facilities in California is far greater than the present supply. Facilities were reported to be overused by more than 30 percent. In addition, there were multitudes who could not be accommodated at the area of their choice or at any comparable area. It was further concluded that this recreation is characteristically water oriented, as was 60 percent of all recreation studied (except travel). No water body in the State--no reservoir, no stream, no lake--is too remote to be used. The report stated that in the North Coastal counties, the most pressing need in 1980 will be for facilities to serve boaters and campers.

Outdoor recreation holds promise of becoming the North Coast's leading industry. Recreational activity along the world famous Redwood Highway is at a feverish pitch throughout the summer months. Table 7 gives an idea of the demand on the state parks in this area.

One of the principal attractions at several of the state parks in the area is swimming and other water-oriented recreation. This is particularly true at Benbow Lake State Recreation Area, Jedediah Smith Redwoods State Park, and Richardson Grove State Park.

The development of water resources projects could help to enhance and diversify recreational opportunities in the region. The most significant recreational potential lies along the rivers and streams. Increased summer flows and man-made lakes would do much to enhance recreational opportunities.

TABLE 7

NORTH COASTAL STATE PARK ATTENDANCE
By Park and Fiscal Year
July 1, 1961 to June 30, 1964

State Park	1961-62	1962-63	1963-64
Benbow Lake State Recreation Area	26,794	49,064	59,086
Fort Humboldt State Historical Monument	3,792	1,966	4,808
Grizzly Creek Redwoods State Park	24,130	22,731	25,255
Hendy Woods State Park	9,461	9,712	49,316
Humboldt Redwoods State Park	300,000*	340,000*	379,057
Jedediah Smith Redwoods State Park	147,976	150,907	192,091
MacKerricher State Park	123,795	127,371	158,096
Patrick's Point State Park	147,395	113,858	105,220
Paul M. Dimmick State Recreation Area	24,277	33,660	32,298
Prairie Creek Redwoods State Park	259,955	236,580	194,537
Richardson Grove State Park	476,535	491,215	471,670
Russian Gulch State Park	81,746	75,066	78,840
Standish-Hickey State Recreation Area	73,766	76,603	83,012
Van Damme State Park	114,594	100,948	168,029
TOTALS	1,814,216	1,829,681	2,001,315

* Estimated from traffic counts.

Fishery Enhancement

The anadromous fish resources of the North Coastal area have dwindled since the turn of the century. The once flourishing canneries which existed near mouths of major streams such as the Klamath and Eel Rivers are no longer present. There is some controversy among authorities as to the dominant causes; however, most will agree that man has played a prominent role in the destruction of these natural resources. The fishery has been damaged by mud and silt entering the river channels. This mud and silt is caused by erosion and sedimentation resulting from logging, road building, overgrazing, and other prevalent land use practices. To some extent the fishery is subjected to chemical and bacteriological contamination from pesticides and industrial and domestic wastes.

The commercial fisheries industry is about as important as agriculture to the economy of the North Coast. Over the past decade,

annual commercial landings have averaged 38,500,000 pounds, or $4,150,000 to the fisherman. Additional jobs and income are provided by wholesalers, packers, and processors. The annual retail value of the commercial fishery products is about $12,000,000. The trend in the industry has been a slow, gradual increase in landings and their value. This trend is expected to continue unless accelerated by technological advances and fleet modernization.

Although commercial fishery development may prove important in broadening the region's economic base, the major contribution that fish and wildlife could make to economic advancement lies in their ability to attract nonresident recreationists. The sport fishery is one of the principal recreational attractions in the area.

Properly formulated water resources developments could serve to enhance the region's anadromous fish populations. Conversely, ill-conceived water development projects could greatly endanger the vital anadromous fishery population of the area. Because of this very possibility, the California Department of Fish and Game is extremely concerned over the future of anadromous fishery resources in North Coastal streams. Their January 1966 report entitled "Fish and Wildlife Problems and Study Requirements in Relation to North Coast Water Development" emphasizes the cause for concern and suggests numerous studies which must be conducted if the future of these valuable resources is to be insured. Fish and wildlife planning at major projects proposed on North Coastal streams is lagging far behind the engineering studies. Recent cost estimates for biological studies at top priority federal projects amounted to about six million dollars over a ten-year period. Funds for these studies are not in sight. Unless this trend is reversed in the very near future, one resource may be lost needlessly at the expense of another.

Related Programs and Investigations

The Action Program is closely related to three other programs and investigations in the Department which also have local development in the North Coastal area as part of their objective. These are the Administration of State Financial Assistance for Local Projects

(Davis-Grunsky Program); the North Coastal Area Investigation; and the Advance Planning Program, Upper Eel River Development.

Administration of State Financial Assistance for Local Projects

To assist local agencies in the financing of needed local water projects, the Legislature enacted Chapter 2052, Statutes of 1957, entitled "State Financial Assistance for Local Projects" (adding Section 12880 to the Water Code). In accordance with Chapter 1762, Statutes of 1959, a sum of $130 million of the California Water Resources Development Bond Fund is provided to finance the program. To date, applications have been approved for a little more than $34 million.

This statewide program provides loans for local project construction costs and feasibility studies. Grants are provided for certain recreation, fish and wildlife enhancement, and initial water supply and sanitary facilities costs. The State may also participate with an applicant as a partner under certain conditions.

The following loans and grants in the North Coastal area have been approved to date:

Agency	Amount	Type
Humboldt Bay Municipal Water District	$300,000	Recreation Grant
Hydesville County Water District	182,000	Distribution System Loan
Alderpoint County Water District	112,000	Distribution System Loan
Manila Community Services District	388,690	Distribution System Loan

In addition, the following agencies in the North Coastal area have applied for loans or grants:

Agency	Amount	Type
Redwoods Junior College Disrict	$185,525	Recreation Grant
Trinity County Waterworks District No. 1	83,000	Recreation Grant
Trinity County Waterworks District No. 1	297,500	Water Supply System Loan
Klamath Community Services District	155,500	Water Supply System Loan
City of Yreka	4,000,000	Water Supply System Loan
Willow Creek Community Service District	1,025,000	Distribution System Loan

North Coastal Area Investigation

The Department originally selected the North Coastal area for long-range and comprehensive investigation on completion in 1956 of studies basic to the California Water Plan. The initial reconnaissance phase of this program was completed during the 1963-64 fiscal year with the publication of Bulletin No. 136. A major recommendation of Bulletin No. 136 was for continuing refinement and modification of plans for major water projects to follow the Upper Eel River Development to reflect statewide demands and technological changes.

The objective of the North Coastal Area Investigation is to formulate plans for the optimum development of the water resources of the region, considering all potential purposes, including anticipated local and export water supply needs, protection against floods, enhancement of fish and wildlife resources, development of hydroelectric power, and development of water-associated recreation potential. The specific objectives of the second phase of this reconnaissance investigation are:

1. To define and compare alternative major multiple-purpose projects in the North Coastal area to follow the Upper Eel River Development, in coordination with the Statewide Planning Office and with the federal and local planning agencies.

2. To identify possible local projects which might be constructed for purposes of local water supply, flood control. recreation, and fisheries enhancement.

3. To build a backlog of information to form the basis upon which the Department can monitor the future development of the North Coastal area and thereby fulfill its responsibility, as set forth in the Water Code, to guide and control this development for the greatest long-range benefits to the State.

4. To provide timely reports and recommendations relative to programs and actions which will be necessary to effect efficient, orderly, and optimum development of the region's water resources.

The second objective above is similar to that of the Action Program. For the last two years, about half of the budget for the program has been put into a study of local water development project possibilities in the South Fork Eel River Basin. Some of the preliminary results of this study are discussed in Chapter V, South Fork Eel River. A bulletin

on the South Fork Eel River Basin will be prepared in June 1967. Beginning in July 1967, a comprehensive three-year basin-wide study of the Eel River Basin will be made to formulate a master plan for the optimum development of the Eel River Basin. This study will evaluate local and export projects.

The limited Fort Bragg - Anderson Valley Local Project Study portion of the Action Program was initiated under the North Coastal Area Investigation in July 1966 and will culiminate in a bulletin in June 1969. This study is discussed in some detail in Chapter VI, Mendocino Coastal Streams.

Advance Planning Program, Upper Eel River Development

The Upper Eel River Development was authorized on March 9, 1964, as an additional unit to the Central Valley Project and as an additional project conservation facility of the State Water Resources Development System. As such its primary function will be to augment water supplies in the Sacramento--San Joaquin Delta and prevent any reduction in the 4,230,000 acre-feet minimum annual yield in the State Water Project.

The overall objectives of the Advance Planning Program are: (1) identify the specific project features which will comprise the Upper Eel River Development; (2) define the nominal capacities, size, and other parameters of the selected features; (3) identify local needs which could be served from the development and define the appurtenant works necessary to supply these needs; (4) determine the relationship between projected benefits and estimated costs for the project as a whole and for the individual project purposes, in order to provide a cost allocation and a project services allocation among the various purposes; and (5) provide comprehensive recommendations for the subsequent programs and actions which will be necessary to design, construct, and operate this facility.

The third objective above is pertinent to the Action Program. Current activities toward this objective are the flood control, recreation, and fish and wildlife studies being made in connection with the proposed reservoirs on the Upper Eel River.

Summary

The growth rates of population and per capita income in the North Coast counties have fallen considerably behind statewide averages. Employment in the area is largely related to lumber, recreation, and agriculture. Seasonal unemployment rates are high.

Water development could help provide needed economic stimulation by providing flood control, new water supplies, new recreational attractions, and improved sport and commercial fisheries. The need for flood control is obvious from the massive impact of the floods of 1955 and 1964. Water requirements in the area by 1990 are estimated to be more than four times what they were in 1960. The need for new recreational opportunities is demonstrated by the over-capacity use of existing facilities in the summer. The need for improved fish habitat is clear from declining fish runs and increasing fishing pressure.

Succeeding chapters will discuss the specific water development needs and possible solutions in the several areas to be covered under this program. The last chapter will indicate the priority of the needs discussed, the work program to meet these needs, and the funding necessary to carry out this program.

CHAPTER II. THE SMITH RIVER

Crescent City and the Smith River Plain are the population centers that would be most affected by local water developments on the Smith River. This chapter discusses the economic development of that area and outlines possible water developments.

Economic Development

The statistical profile in Chapter I presented information on population growth, income, and employment in Del Norte County. The Crescent City-Smith River Plain area is by far the largest population center in Del Norte County. This section describes transportation facilities, industrial development, land use and existing water use in this area.

Transportation

Crescent City is served by Highway 101, "The Redwood Highway", and Highway 199, which connects the Redwood Highway with Interstate Highway 5 at Grants Pass, Oregon. Crescent City has a deep water harbor which serves both commercial fishing boats and lumber ships. There is no railroad service within the Smith River Basin.

If the Northwestern Pacific Railroad were extended from Eureka to Crescent City or the Southern Pacific Railroad from Grants Pass, both distances of about 85 miles, a substantial saving could be made in shipping lumber. With rail service, Crescent City would be more able to compete with other areas for new industry.

Industry

While agriculture and commercial and sport fishing exist in this area, the economy is almost totally dependent upon the lumber industry. Most of Del Norte County's marketable timber is in the Six Rivers National Forest. The U. S. Forest Service permits the timber to be cut on a sustained-yield basis, which means there will be very little future reduction in the lumber industry, compared with Humboldt and Mendocino Counties, where sustained-yield harvesting has not been practiced extensively.

Land Use

Almost all of the 29,300 acres of irrigable land in the Smith River Basin is in the Smith River Plains. Of 12,000 acres presently in agricultural use, only 3,300 acres have been irrigated. Four thousand five hundred acres are in urban areas, 15,500 acres in State Parks, and the remainder is almost all forest and grazing land.

In 1958, 80 percent of the farmland was pasture, 3 percent truck crops, mainly bulbs and flowers, 7 percent grain and the remainder fallow.* In recent years there has been a trend toward more flower and bulb production. The amount of agricultural land is limited and urban encroachment is reducing this already scarce resource.

Existing Water Use

During 1958 there were 4,500 acre-feet of water diverted from streams in the area. This did not include diversions of less than 10 acre-feet per year. Lumber mills account for 69 percent of this total, the rest going to urban and irrigation use. It was estimated that for 1958 the total consumptive use of water was about 4,000 acre-feet; of this total about 1,600 acre-feet went to agriculture, 1,000 acre-feet to municipal and urban, and the remainder to lumber mills.*

Local Needs and Possible Solutions

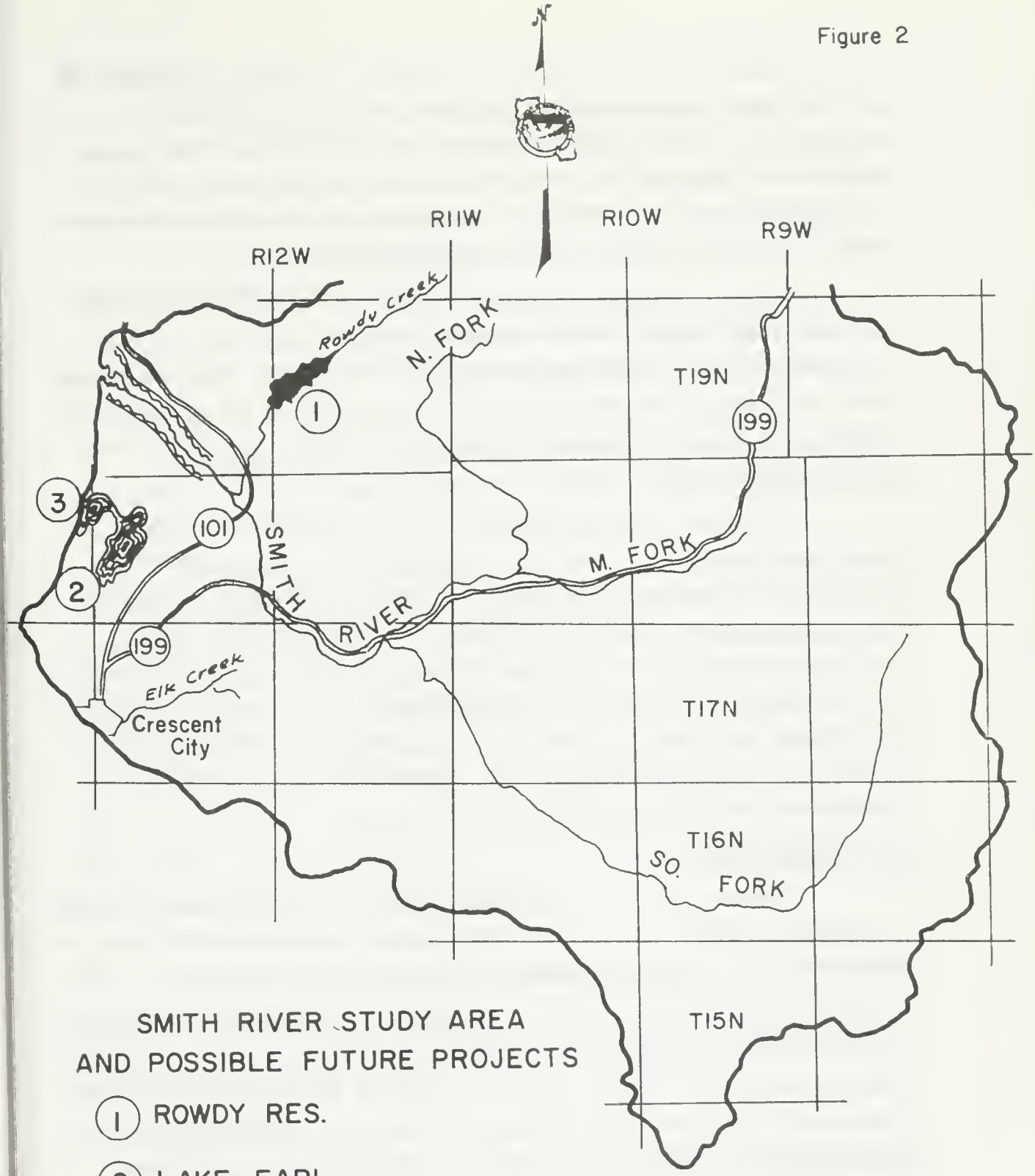
This section describes the local needs for water development in the Smith River Basin and outlines possible projects to satisfy these needs. Figure 1 shows the Smith River study area, specific problem areas, and possible future projects.

Flood Control

The Smith River, like other North Coastal streams, has had frequent floods, but due to the sparse development along the river, damage has been less than that occurring on some of the other North Coast streams. Damage has been mostly confined to deposition of silt on farmland and erosion along highways.

* Figures taken from Department of Water Resources Bulletin No. 94-4, "Land and Water Use in the Smith River Hydrographic Unit", January 1965.

Figure 2



SMITH RIVER STUDY AREA
AND POSSIBLE FUTURE PROJECTS

(1) ROWDY RES.

(2) LAKE EARL

(3) LAKE TALAWA

Damage to roads frequently results from economic decisions to build the least expensive road (usually closest to the stream) with the chance that it will be obsolete before it is washed away. This may be economically justified, but flood protection for such roads could not be justified, since the added cost of building the road in a safe place would be less than the cost of providing flood protection.

Crescent City is frequently damaged by floods from Elk Creek and other small creeks that flow through the town. Levees and channel improvements would provide the necessary flood control. The Smith River Delta can probably best be protected by a levee system and by proper zoning. The Corps of Engineers is presently studying the Smith River and will report on it in 1968.

Additional flood problems exist in the Lake Earl and Lake Talawa area north of Crescent City. During floods, the runoff of a 30-square-mile drainage area raises the level of the lakes to inundate surrounding pasture land. New subdivisions being developed around Lake Earl may also be endangered. Permanent controlled outlet works would alleviate this problem. The Department studied this possibility in 1962 and found such a project to be economically unjustified for flood control alone; however, it was suggested that it be studied further as a multiple-purpose project.

Water Requirements

Although there is no immediate need for any appreciable amount of new water, additional water will be needed if the area is to have new industry or if the types of farming in the area are changed.

The new subdivisions around Lake Earl will depend on individual wells for their water supply. Although ground water supplies are sufficient to provide for these subdivisions, future development may require provisions for protection or recharge of the ground water basin or development of surface water supplies. A reservoir on Rowdy Creek, operated in conjunction with diversion from the Smith River, could provide sufficient water for Crescent City and the Smith River Plain.

Recreation

Besides the various forms of fishing, the only other water-oriented recreation in the area is swimming in the Smith River above the fog belt. There are lagoons nearby that are used only to a limited extent for boating and water skiing. It is expected that water areas located inland from the coastal fog would be popular with redwood park visitors for swimming and boating.

Rowdy Creek Reservoir could provide a boating area, but it too would be in the fog belt and the reservoir would be too small for speed boats.

Probably the simplest way to improve water-oriented recreation is to provide better access to the Smith River, where swimming and picnic areas exist.

Lake Earl and Lake Talawa could be developed for various uses. A wildlife refuge could be made of them, but this provides little dollar value to the area. Probably the best use of these two connecting lakes would be some kind of multiple use, perhaps by constructing a barrier between them and providing controlled outlet structures. Lake Earl would then be a fresh water lake suitable for waterfowl management with restricted boating. Also, if Lake Talawa were open to the ocean, it would be suitable for wintering black brant or could serve as a harbor. Several small islands off the coast could be designated as bird sanctuaries to preserve several species of shore birds.

There has been considerable attention given to a proposed Redwoods National Forest in the lower Smith River Basin. If this park becomes a reality it would greatly increase the numbers of visitors to the area. This influx would in turn increase the need for more water-associated recreational facilities.

Fishery Enhancement

There are streams and coastlines in Del Norte County which are not fished because of limited access. Access by trail rather than road is desirable in many places, but often private land cuts off access entirely. Rights-of-way should be purchased in such cases.

Streams that are blocked by log jams should be cleared and possibly parts of the Smith River gravel beds should be mechanically loosened or cleaned to improve spawning for king salmon.

The construction of Rowdy Creek Reservoir would create a limited fishery. If Lake Earl and Lake Talawa were developed, as previously mentioned, Lake Earl could create a freshwater fishery and Lake Talawa would provide a brackish water fish habitat.

Future Work Program

The possible future water development projects mentioned in this chapter included: (1) Smith River flood protection works; (2) Rowdy Creek Reservoir to provide for future water requirements in the Crescent City--Smith River Plain area; (3) small flood protection works (levees and channel improvements) on Elk Creek and other small streams that plague Crescent City; and (4) development of water level controls and salt water barriers at Lake Earl and Lake Talawa to provide flood protection and new recreation opportunities.

The Corps of Engineers is presently studying projects to provide flood control on the Smith River. However, there are no current planning programs, State or Federal, that would evaluate the other projects mentioned.

It is recommend that funds be provided to enable the Department of Water Resources to undertake a study of these projects -- Rowdy Creek Reservoir, flood protection works for Crescent City, and controls for Lake Earl and Lake Talawa.

Major work items involved in the Rowdy Creek study would include: (1) updating and refining estimated future water requirements for Crescent City and the Smith River Plain; (2) hydrology studies to estimate flows of Rowdy Creek and to estimate the potential yield available from Rowdy Creek Reservoir; and (3) geology and design studies to determine the probable cost of Rowdy Creek Reservoir and a primary distribution system.

A study of flood protection works for Crescent City would involve: (1) a field reconnaissance of flood problems; (2) preparation

of flood frequency curves and flood damage estimates; and (3) layout and design of preventive works - levees and channel improvements.

A study of the Lake Earl and Lake Talawa problems would include: (1) preparation of suitably scaled topographic maps of the area; (2) hydrology studies to determine flood inflows and lake level fluctuations; (3) contracts with fish, wildlife, and recreation specialists to determine possible effects of proposed projects on fish, wildlife, and recreation; and (4) design of facilities to control lake level fluctuations.

A program to study these three projects would last about 24 months and cost approximately $100,000. If budgeted as a part of an overall North Coastal area study of local projects, as proposed in this report, this study would begin in January 1967 and be completed in December 1968.

CHAPTER III. MAD RIVER

The Arcata-Eureka-Humboldt Bay population center would be most affected by local water developments on the Mad River. Consequently, this area was included in the Mad River Study area as shown on Figure 2. The Humboldt Bay Municipal Water District owns and operates Ruth Reservoir on the Mad River. This chapter discusses the economic development of this area and outlines possible future water development projects on the Mad River.

Economic Development

The statistical profile in Chapter I presented information on population growth, income, and employment in Humboldt County. The Arcata-Eureka-Humboldt Bay area is the largest population center in Humboldt County.

Transportation

This area has the best transportation system of any area in the three counties discussed in this report. It is served by the Northwestern Pacific Railroad, Pacific Airlines, a deep water harbor, and two major highways, U. S. 101 and State Route 299.

Industry

The primary industries of the area, like the other North Coastal areas, are lumber and industries associated with lumber. There are presently two large pulp mills in the area, which use waste material from lumber mills in the surrounding area.

Other industries in the area are fish processing and milk processing. Since the source material for food processing is limited, there is little opportunity for expansion of this industry.

Land Use

There are about 48,000 acres of irrigable land in the study area, of which 22,500 acres are in agricultural use. Only 5,800 acres of this land are presently irrigated. There are 13,600 acres of urban land in the area. Most of this land is in the Eureka Plain and was irrigable before it was urbanized.

Forest and rangeland account for about 90 percent of the area. Virtually all the land in the humboldt County portion of the study area is in private ownership. The upper third of the Mad River Basin is in Trinity County. Most of this area is in the Six Rivers National Forest.*

Existing Water Use

In 1962, Ruth Reservoir was completed. It was to have supplied sufficient new water to meet all the demands of the area for many years; unfortunately, the estimate of water demand was too low and the demand for water has already exceeded the dependable yield of the project. In 1960, the annual consumptive use of water in the area was only about 10,000 acre-feet. Since that time, two pulp mills have been built and each is planned for expansion in the near future.

Local Needs and Possible Solutions

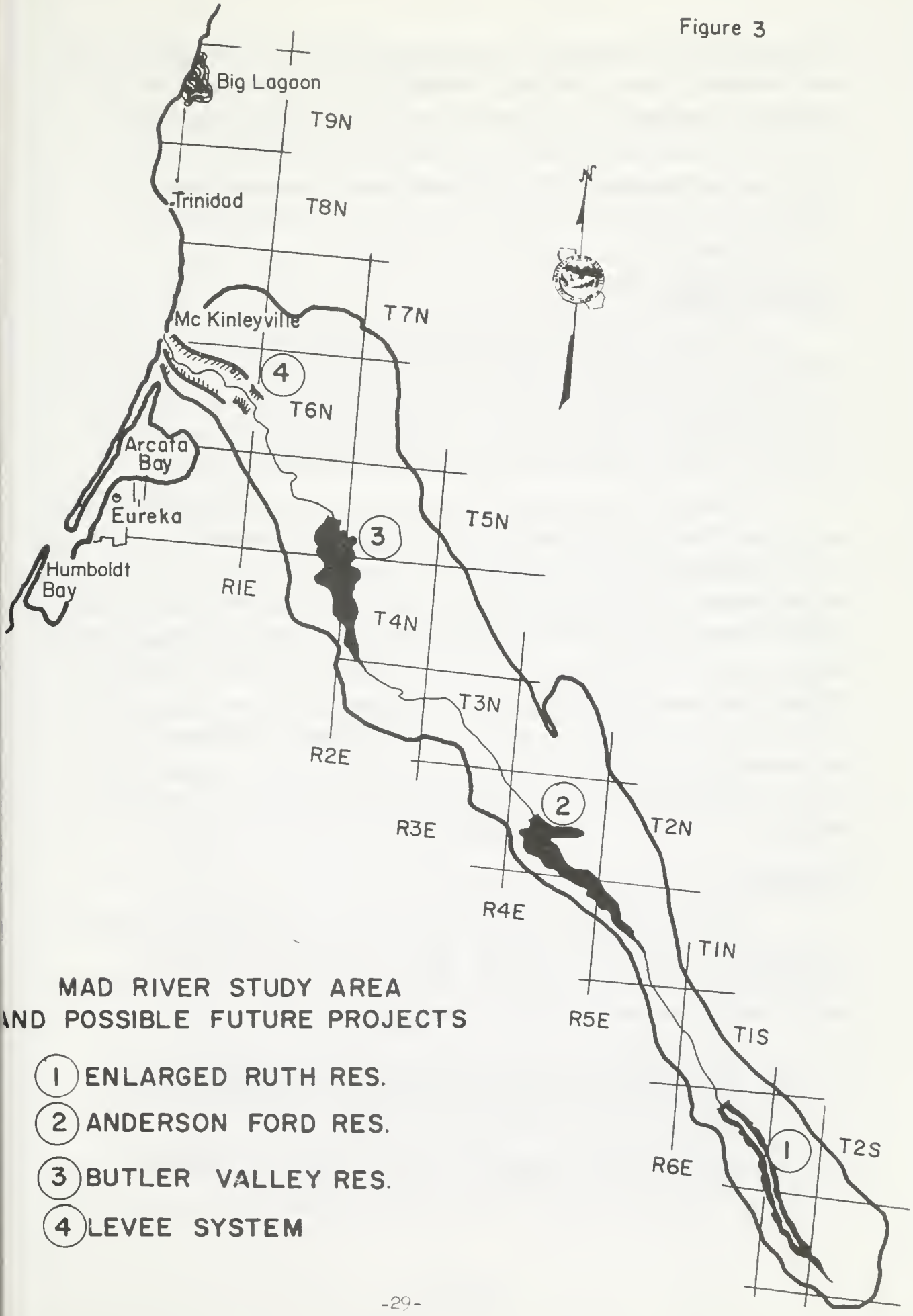
This section describes the local needs for water development in the Mad River Basin and outlines possible projects to satisfy these needs. Figure 2 shows the Mad River study area and specific problem areas and possible future projects.

Flood Control

The greatest need for flood protection in this area is on the lower Mad River. Butler Valley Reservoir on the Mad River would provide

* Figures taken from Department of Water Resources, Bulletin No. 94-7, "Land and Water Use in Mad River--Redwood Creek Hydrographic Unit", October 1963; and Bulletin No. 94-8, "Land and Water Use in Eel River Hydrographic Unit", August 1965. The study area includes the Eureka Plain subunit of the Eel River Hydrographic Unit and all of the Mad River--Redwood Creek Hydrographic Unit with the exception of the Orick, Beaver, and Snow Camp subunits.

Figure 3



MAD RIVER STUDY AREA
AND POSSIBLE FUTURE PROJECTS

(1) ENLARGED RUTH RES.

(2) ANDERSON FORD RES.

(3) BUTLER VALLEY RES.

(4) LEVEE SYSTEM

nearly full flood protection. Some additional levees are required, along with floodplain zoning. The main problem is how to accelerate the construction and provide for maximum recreation and fishery enhancement. The Corps of Engineers is currently studying the Mad River and will report on their study in 1967. The Department is cooperating in this study and will consider the possibility of participating in a flood control project.

Water Requirements

There is an immediate need for new water in this area. Butler Valley Reservoir could provide all the foreseeable need for new water if it is made large enough. If there is any delay in its construction, serious consequences could occur. In sizing Butler Valley Reservoir, sufficient allowance should be made for fish enhancement releases.

Several of the coastal communities just north of the Mad River, particularly McKinleyville and Trinidad, experienced severe water shortages in the summer and fall of 1966. County officials have asked the Department for assistance in planning for adequate water supplies. Alternative early sources of water could be made available through further development of ground water in the McKinleyville area or small reservoirs on Little River or Luffenholtz or Maple Creeks. Although the Butler Valley Project could serve all or a portion of this area, the area's development could be retarded for the several years it will take for the planning, authorization, and construction of the larger federal or possibly federal-state project.

Recreation

There is a pressing need in the area for warm-water recreation: swimming, water skiing and boating. This need could be satisfied by Butler Valley Reservoir. Subject to economic and financial constraints, the following conditions should be provided.

> The reservoir is sized with a normal water surface elevation of at least 600 feet and a minimum water surface elevation of at least 400 feet with the water surface not dropping below 500 feet except in severely dry years.
>
> The flood control operation schedule allows the reservoir to fill or nearly fill in the late spring.

Sufficient land is purchased around the reservoir to insure full recreational development.

Paved roads are constructed from Korbel to Butler Valley and around the reservoir.

Sufficient recreational facilities are constructed at the reservoir.

To fully realize the recreation potential of Butler Valley Reservoir, an access strip should be purchased along both sides of the river from the dam to the ocean, including the floodplain inside the levee system. Access should be provided for this area. This area could be developed later as needed, but the land should be purchased before it is developed for urban use. This action would also prevent destruction of the spawning beds by gravel operations and other man-made disturbances.

Fishery Enhancement

The Mad River could produce many times the number of anadromous fish that it now does, and could provide much more fishing pleasure, under the right conditions. In planning the construction of Butler Valley Reservoir the following conditions should be considered to insure optimum development of the lower Mad River.

Suitable flow on the lower Mad River at all points, including below the last diversion.

Multiple-level outlet works in Butler Valley Dam.

Removal of Sweasy Dam and excavation of a large channel through the silt in Sweasy Reservoir.

Purchase of all the land along the river up to at least a normal flood level from Butler Valley Dam to the ocean.

Prohibition of removal of gravel from the riverbed below Butler Valley Dam, including the North Fork of the Mad River.

Special fishing regulations for the Mad River, with the emphasis on "fishing for fun".

A continuing program for spawning bed improvement - cleaning and loosening of gravel, channelizing, and debris clearing.

Between Ruth Reservoir and Butler Valley Reservoir there are about 50 miles of trout stream. At the present time there is insufficient flow during the late spring and early summer because only five cubic feet

per second are released from Ruth Reservoir until the flow at Essex drops below that required for diversion. From the time Butler Valley Reservoir is constructed until Anderson Ford Reservoir is constructed (approximately 20 years), the yield of Ruth Reservoir could be used to increase the summer flow of this portion of the Mad River.

Future Work Program

The possible future water development projects mentioned in this chapter included: (1) Butler Valley Reservoir on the Mad River; (2) ground water development for a domestic water supply for the McKinleyville-Trinidad-Big Lagoon area; (3) storage developments on Little River or Maple or Luffenholtz Creeks to provide a surface water supply to this area; (4) channel improvements for fishery enhancement on the Mad River; and (5) potential utilization of Ruth Reservoir if Butler Valley Reservoir is constructed.

The United States Army Corps of Engineers is presently conducting a detailed study of the Butler Valley Project. The Corps should also evaluate the fishery enhancement potential on the Mad River in conjunction with their studies of Butler Valley. There are no planning studies in progress, state or federal, to determine the best source of water supply for the McKinleyville to Big Lagoon area or to evaluate the potential use of Ruth Reservoir in the event of the construction of Butler Valley Reservoir.

It is recommended that funds be provided to enable the Department of Water Resources to undertake a study of the McKinleyville to Big Lagoon area and to study the potential of operating Ruth Reservoir for downstream fishery enhancement once Butler Valley Reservoir is constructed.

Major work items involved in the McKinleyville to Big Lagoon area investigation would include: (1) updating and refining estimated future water requirements for the area; (2) geologic and hydrologic studies to evaluate the potential future use of ground water in the area; (3) hydrology studies to estimate inflows and potential yields from possible reservoir projects on Little River, Luffenholtz Creek,

and Maple Creek; (4) geology and design studies to determine the probable costs of these reservoirs; and (5) hydrology and design studies to determine the possibility of serving this area from the Butler Valley Project.

A study of the potential interim use of Ruth Reservoir, from the time that Butler Valley Reservoir is operating until export projects are constructed on the Mad River, would involve (1) the preparation of detailed operation studies and (2) contracts with fishery and recreation specialists to determine the potential for increasing the fishery enhancement and recreation benefits accruing to this reservoir.

A program to evaluate these two problems would last about 24 months and cost approximately $100,000. If budgeted as a part of an overall North Coastal area study of local projects, as proposed in this report, this study would begin in January 1967 and be completed in December 1968.

CHAPTER IV. VAN DUZEN RIVER

The communities in the Eel River Delta and in the upper reaches of the Van Duzen River are the population centers that would be most affected by water development on the Van Duzen and lower Eel Rivers. This chapter discusses the economic development of that area and outlines possible water development for the area.

Economic Development

The statistical profile in Chapter 1 presented information on population growth, income, and employment in Trinity and Humboldt Counties. The population of the Van Duzen River and Eel Delta areas, with the exception of Ferndale, is concentrated along U. S. Route 101, the Redwood Highway, and State Highway 36. The growth of the area along the Redwood Highway has been similar to that of the Humboldt Bay area, but most of the remaining area has remained nearly static. The upper Van Duzen River, above Dinsmores, has seen considerable development within the last decade.

Transportation

The Northwestern Pacific Railroad and the Redwood Highway are the major transportation routes serving the lower Van Duzen Basin and the Eel Delta. Both of these routes also serve the deep water port at Eureka, about twenty miles from the mouth of the Van Duzen. Of secondary importance is State Highway 36, providing a route east to the Sacramento Valley.

Industry

Lumbering and production of wood products are the major industries within the area. Agricultural industries include dairy and beef cattle production and associated industries, such as milk processing.

By-products of the lumber mills in the area are shipped to the pulp mills at Eureka. However, because of the pollution problems

associated with pulp mills and the lack of port facilities, the Van Duzen Basin and the Eel Delta are not particularly suited for this industry. Future development would probably be in industries associated with agriculture.

Land Use

Nearly all of the land in the Van Duzen Basin is either forest or grazing land. Some land on the upper Van Duzen above Dinsmores and on the lower Van Duzen below Yager Creek, a total area of about 2,900 acres, is suitable for farming.

The Eel Delta, much of which is frequently flooded, is used mostly for dairy and beef cattle production. About 10,000 acres of this area are irrigated and about 18,000 acres are dry-farmed.*

Existing Water Use

Irrigation in the Van Duzen Basin above Carlotta is practically non-existent. As of 1960, the total annual irrigation requirement for the entire basin was about 20,000 acre-feet. Urban and industrial use in the area is small.

Local Needs and Possible Solutions

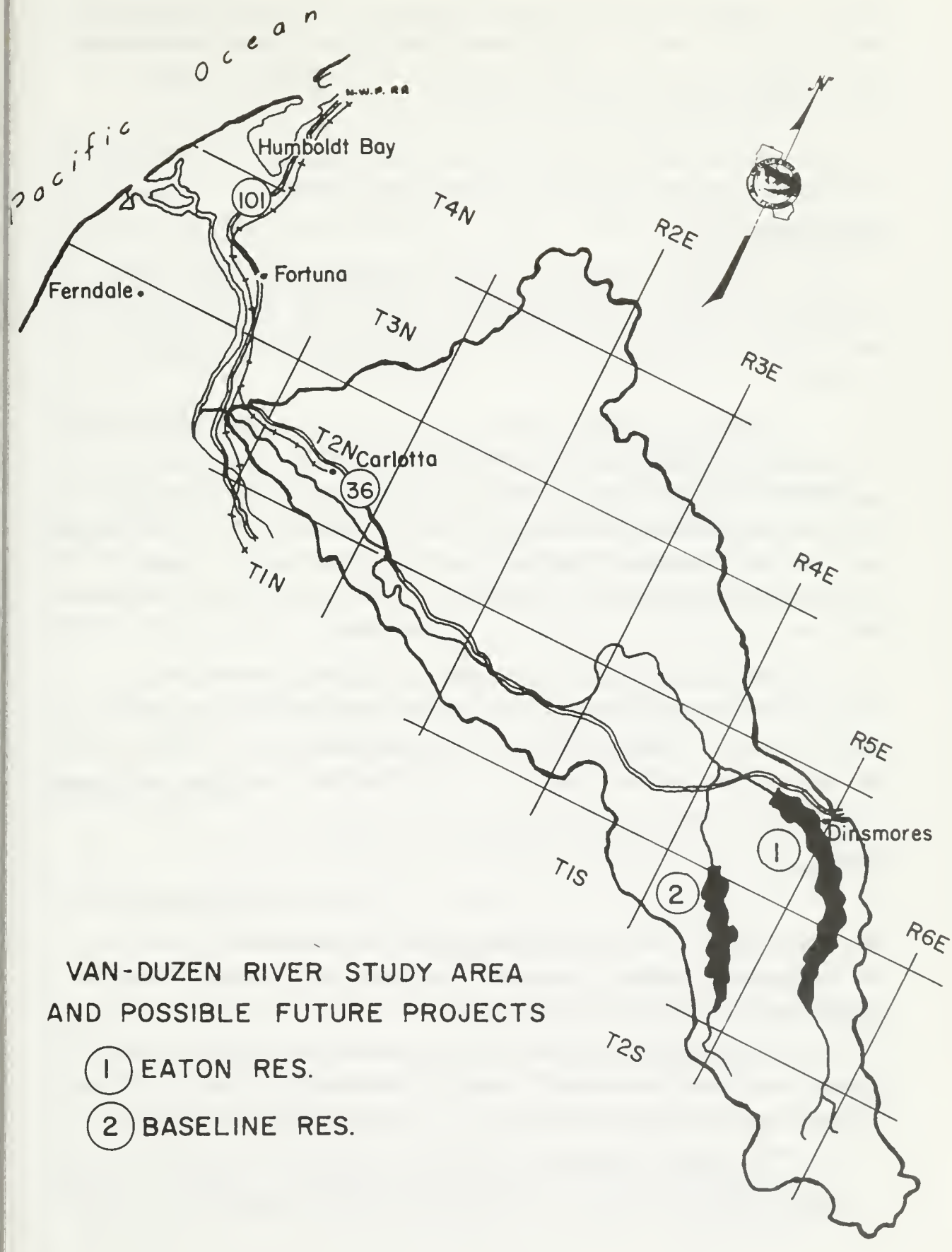
This section describes the local needs for water development in the Van Duzen River Basin and the Eel Delta and outlines possible projects to satisfy these needs. Figure 3 shows the Van Duzen River study area and possible future projects.

Flood Control

The results of the great floods of 1955 and 1964 emphasized the need for flood control in the Eel River Delta. The U. S. Corps of Engineers is presently designing a levee system to protect this area. In the design of this system, provision should be made for recreational

* Figures taken from Department of Water Resources Bulletin No. 94-8, "Land and Water Use in Eel River Hydrographic Unit", August 1965.

Figure 4



VAN-DUZEN RIVER STUDY AREA
AND POSSIBLE FUTURE PROJECTS

(1) EATON RES.

(2) BASELINE RES.

facilities, fish and wildlife enhancement, and zoning of the surrounding land outside the levees. This zoning should restrict urban encroachment upon farmland, and it should reduce the chance of property damage and loss of life if the levee should fail.

Flood control measures on the Van Duzen River would be limited to proper flood zoning and good watershed management.

Water Requirements

At present, there is no urgent need for an additional water supply in the area. However, there are 15,000 acres of irrigable land not presently irrigated and there is a potential for more industry in the area.

The most pressing needs at present are for higher flows during the summer to prevent seawater intrusion and to improve the trout and anadromous fisheries. Use of additional water from the ground water basin in the delta and increased diversion of upstream flows will increase the need for providing for higher flows to the Eel Delta. Fishery enhancement and recreational reservoirs on the Van Duzen and South Fork Eel Rivers could help to provide for these needs.

The proposed Baseline Reservoir on the South Fork of the Van Duzen River could provide up to 150 cfs of additional flow during the dry months. Although this is an insignificant amount at the mouth of the Eel, several similar reservoirs within the whole Eel River Basin would considerably alleviate the problems of low summer flows.

Recreation

Throughout most of the Van Duzen Basin, summer temperatures are high enough to make water-oriented recreation attractive. In the Eel Delta area, however, the coastal fog limits the potential for such activities as swimming and water skiing.

Baseline Reservoir on the South Fork of the Van Duzen could provide facilities for fishing, swimming, and boating, although its small surface area, 200 acres when full, may limit the use of power boats.

When Eaton Reservoir is built, it will provide over 5,000 acres of water surface when full. Eaton Reservoir area is well above the fog

belt and climatically well suited for water-oriented recreation. Highway 36 now passes through the reservoir area.

The area inside the proposed Eel River Delta Levee System could be used for many recreational activities if such provision were made prior to construction. The area could provide: hunting areas for upland game and waterfowl; fishing areas for salmon, steelhead, shad, and other fish; and camping and picnic areas. Other possible uses would be boating, horseback riding, and motorcycle riding, or the area could be used as a wildlife sanctuary. Studies would be required to determine which uses would provide the optimum utilization of the area and which would be compatible with each other.

Fishery Enhancement

Historically, the lower Eel River had higher summer flows, a more confined channel lined with large trees, and probably lower water temperatures. These conditions were changed by man through the years. The fishery could be improved by proper watershed management, a well engineered levee system in the Eel Delta, and fishery enhancement releases from upstream reservoirs.

As previously mentioned, Baseline Reservoir on the South Fork of the Van Duzen could enhance the fishery of the Van Duzen River as well as contribute to higher flows in the lower Eel River.

Future Work Program

The possible future water developments mentioned in this chapter included: (1) Baseline Reservoir on the Van Duzen River, and (2) the Eel River Delta Levee System.

The United States Army Corps of Engineers is working on the final design phases of the Eel River Delta Levee System. This system would provide flood protection for urban and agricultural lands and could offer an opportunity for recreational development and fish and wildlife enhancement. Both the Department of Water Resources and the U. S. Bureau of Reclamation are studying projects on the upper Van Duzen River for export of water to the Central Valley via the Trinity River. However, studies are needed to evaluate the potential for local projects, such as Baseline, on the Van Duzen for fishery enhancement and to provide a water supply to the lower Van Duzen and Eel River Delta areas.

It is recommended that funds be provided to enable the Department of Water Resources to undertake a study of potential local projects on the Van Duzen River.

Major work items involved in this study would include: (1) updating and refining future water requirements for the lower Van Duzen and Eel River Delta areas; (2) hydrology studies to determine inflows and potential yields from possible reservoir projects on the Van Duzen River; (3) geology and design studies to determine the probable costs of these reservoirs; and (4) contracts with fishery and recreation specialists to determine the potential fishery enhancement and recreation benefits obtainable by these projects.

A program to study potential local water development projects on the Van Duzen River would last about 24 months and cost approximately $75,000. If budgeted as a part of an overall North Coastal area study of local projects, as proposed in this report, this study would begin in January 1970 and be completed in December 1971.

CHAPTER V. SOUTH FORK EEL RIVER

The Department of Water Resources is currently conducting a reconnaissance study of the South Fork Eel River Basin as a part of its continuing North Coastal Area Investigation. This two-year program will be completed in June 1967 and a report will be published shortly thereafter as a DWR bulletin.

The small communities in the South Fork Eel River canyon would be the principal beneficiaries of water development in the South Fork Eel River Basin. However, projects in this basin might also be utilized to provide supplemental water supplies to the Eel River Delta area. This chapter discusses the economic development of the South Fork Basin and outlines possible water developments in the basin.

Economic Development

The statistical profile in Chapter I presented information on population growth, income, and employment in Humboldt and Mendocino Counties. The population of the South Fork Eel River Basin is distributed among several small communities along the river, principally Laytonville, Garberville, Redway, and Weott.

Transportation

The only transportation route through the South Fork Eel Basin is the Redwood Highway, U. S. Highway 101. State Route 1, the coast highway, intersects the Redwood Highway at Leggett. The only east-west highways serving the area connect with U. S. 101 outside of the basin. These are State Route 36 in the north at Alton and State Route 20 in the south near Ukiah. The nearest railroad is the Northwestern Pacific which parallels the main stem of the Eel River.

Industry

The major industry in the area is lumbering, with businesses offering recreation and serving the needs of travelers through the area ranking second. The lumber industry has remained at a steady level for

years and will probably decline as the virgin timber in the area is used. Logging will be reduced to the point where the industry uses the resources on a sustained-yield basis. However, greater use of the wood in more products with less waste is expected in the future.

Greater numbers of tourists traveling through the area and the increasing demand for recreation facilities indicate that the tourist and travel industries will continue to increase at an even greater rate than in the past. The development of water-associated recreation sites in the South Fork Basin would attract more visitors for longer stays than the scenic redwood groves.

Land Use

Nearly all of the South Fork Basin consists of forest or grazing land, most of which is privately owned. Twenty-three thousand acres, or just over five percent of the area, lie within the Redwood State Parks.

Although there are about 16,000 acres of irrigable land within the basin, only about 2,000 acres are farmed, and less than 1,000 acres are presently irrigated.*

Existing Water Use

Only a few thousand acre-feet of water is diverted annually from the South Fork Eel River, most of it for lumber mills and domestic use.

Local Needs and Possible Solutions

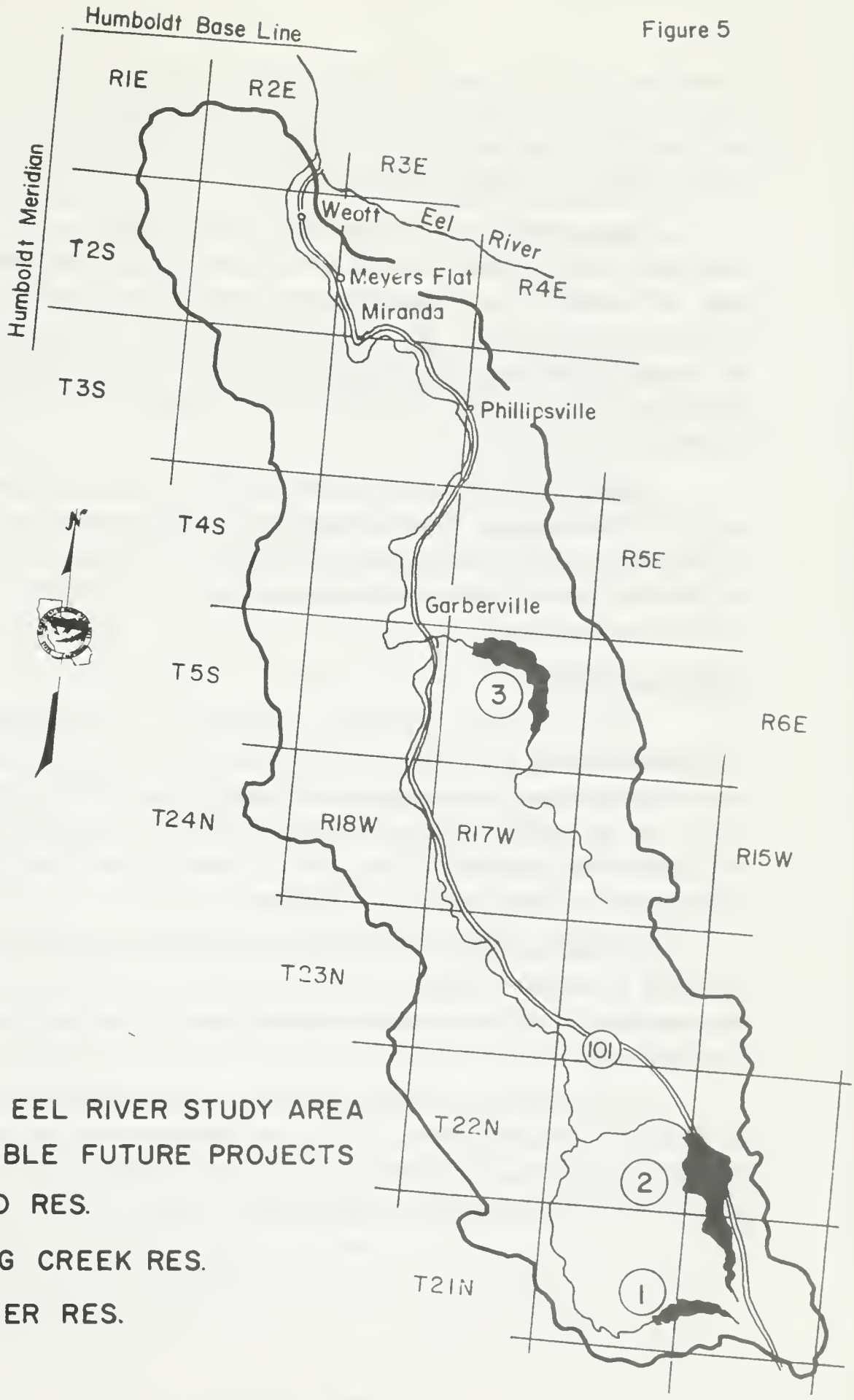
This section describes the local needs for water development and outlines some of the possibilities to satisfy these needs. Figure 4 shows the South Fork Eel River Basin and the location of possible future projects.

Flood Control

The lower South Fork of the Eel has suffered severe flood damage in the past. During the disastrous flood of December 1964 the river reached

* Figures taken from Department of Water Resources Bulletin No. 94-8, "Land and Water Use in Eel River Hydrographic Unit", August 1965.

Figure 5



SOUTH FORK EEL RIVER STUDY AREA
AND POSSIBLE FUTURE PROJECTS

(1) CAHTO RES.

(2) SPRING CREEK RES.

(3) PANTHER RES.

a peak flow of 199,000 cubic feet per second at Miranda, with a total runoff of 328,000 acre-feet in three days. The communities from Phillipsville to the mouth of the South Fork, including Miranda, Myers Flat, and Weott, suffered extensive damage.

Large flood control reservoirs would be impractical on the South Fork because of the size and cost of dams involved and because the lands the reservoirs would flood are more valuable than the lands the reservoirs would protect. The cost of relocating U. S. Highway 101 and the damages to the anadromous fishery, the redwood parks, and commercial timber land would outweigh the flood control benefits derived from such reservoirs.

Most of the potential reservoir sites on the tributaries to the South Fork would not control enough of the drainage area or would be too small to provide sufficient flood control. Therefore, solutions to the flood control problem apparently are limited to floodplain zoning and watershed management.

Water Requirements

There will be only nominal increases in the demand for water from the South Fork Eel River, and, since use by the lumber industry is expected to decline, this increase will mainly supply domestic requirements. Due to the low flows during the summer, however, any increase in diversion could be detrimental to fish. The increase in population along the river could also create pollution problems.

Therefore, there is a definite need to increase the flow of the river during the summer to provide for increased diversion, insure adequate fish flows, and protect the inhabitants of the area from contaminated water.

If surplus water above these local requirements were developed by projects on the South Fork, it could be used downstream in the main Eel River Delta area. This area will eventually have a need for additional water in the summer for agricultural and domestic use.

Recreation

Generally, the South Fork of the Eel is climatically well suited for water sports. However, with the exception of Lake Benbow, there are presently no large bodies of water on which to operate power boats. Lake Benbow had 59,000 visitor-days of use in 1964 despite its limited size of 123 acres and the fact that water skiing is restricted by a limit of 15 boats on the lake at one time.

Spring Creek, Panther, and Cahto Reservoirs would provide excellent opportunities for water-associated recreation. Releases from these reservoirs for streamflow enhancement would be a boon to resorts and recreationists along the South Fork. Another potential source of new recreation opportunities exists in the construction of very small gravel dams to provide recreational pools during the summer months. These dams are washed out by the first high water each fall and consequently provide no barrier to anadromous fish migrations, which do not begin until these high flows occur. These gravel dams are best suited for construction by the individual resort or community concerned.

Fishery Enhancement

Fishing on the South Fork of the Eel, which is fished throughout most of the year, can be divided into two types. During the fall and winter, salmon and steelhead fishing is done by residents of the Bay Area and the Sacramento Valley, who travel to the area just to fish. During the summer, fishing for trout, which are actually young steelhead, is done by tourists and vacationers whose primary purpose is other than fishing.

Conditions which cause fishery problems on the South Fork of the Eel are typical of those in the North Coast area in general. These include the following:

Insufficient summer flows
Winter flooding
High water temperatures during the summer
Stream blocked by logjams and dams
Poor condition of spawning gravels
Excessive turbidity

All of these conditions could be improved, but not completely corrected, by the construction of Spring Creek, Panther, and Cahto Reservoirs. The most difficult conditions to correct are high water temperatures, floods, and excess turbidity. A possible solution to these problems would be the construction of a large dam on the main channel of the South Fork. However, this solution is not practical because most of the development within the area is along the main South Fork and because the loss of the anadromous fishery above the dam would outweigh the downstream benefits.

Future Work Program

The possible future water development projects mentioned in this chapter included: (1) Spring Creek Reservoir on Tenmile Creek; (2) Panther Reservoir on the East Branch of the South Fork; (3) Cahto Reservoir on the upper South Fork; and (4) small gravel dams on the main stem of the South Fork.

As previously mentioned, the Department of Water Resources is currently conducting a reconnaissance-level planning investigation of the South Fork Eel River. This study will be completed in June 1967. The report on these studies will provide the foundation for detailed advance planning or feasibility-level studies of specific projects in the South Fork Eel River Basin. However, there are presently no funds available in the Department's budget to initiate these studies.

It is recommended that funds be provided to conduct a feasibility-level study of the best project (probably Spring Creek Reservoir) identified by the upcoming South Fork Eel River Study report. Depending on the findings of this first feasibility report, funds should then be provided to conduct feasibility-level studies of any other projects shown to be economically justified in the South Fork Eel River Study report.

Major work items in a feasibility-level study of a specific project on the South Fork would include: (1) detailed geologic subsurface explorations and materials testing; (2) preparation of refined designs and cost estimates that could provide a basis for preparation of contract specifications; (3) detailed engineering and economic studies

to determine project benefits and an allocation of project costs; and (4) a study of potential sources of project financing.

A program to study one of the South Fork Projects at the feasibility level would last about 24 months and cost approximately $120,000. If budgeted as a part of an overall North Coastal area study of local projects, as proposed in this report, this study would begin in January 1968 and be completed in December 1969.

CHAPTER VI. MENDOCINO COASTAL STREAMS

The Mendocino Coastal area is here considered to consist of all of the coastal drainage area between the Mattole River on the north and the Russian River on the south. The major streams in the area are the Tenmile, Noyo, Big, Navarro, Garcia, and Gualala Rivers. This chapter discusses the economic development of this area and outlines possible water developments for the area.

Economic Development

The statistical profile in Chapter I presented information on population growth, income, and employment in Mendocino County. The Mendocino Coastal area had a population of about 18,000 in 1960, or about one-third of that of the county. Fort Bragg, with a population of about 7,000, is the largest city in the area. This section describes transportation facilities, industrial development, land use, and existing water use in this area.

Transportation

The principal transportation link in the area is State Route 1, the Shoreline Highway, which runs the length of the coast. Highways from Willits, Ukiah, and Cloverdale connect the coastal area with Highway 101 and areas to the east. Fort Bragg is also served by scheduled commercial flights of Pacific Airlines and rail connection with Willits. A small amount of waterborne traffic uses the harbors at Noyo, Caspar, and Mendocino.

Industry

The principal industries of the area are lumbering, agriculture, commercial fishing, and fish processing. The main plant of the Union Lumber Company, one of the three largest redwood mills in the world, is located in Fort Bragg. The leading farm products in terms of dollar sales over a period of years are pears, beef cattle, wine grapes, and sheep and wool.

Land Use

Only about two percent, or 21,300 acres, of the study area was used for agriculture, urban, or recreational purposes in 1959. Of 6,500 acres in agriculture, about one-third was irrigated. Urban development accounted for about 6,700 acres, and recreational development 8,300 acres. About 84 percent of the recreational area was in parks, the remainder in summer home areas and trailer and camp sites.

Existing Water Use

Water requirements in the area are served almost entirely by diversion of stream runoff. Diversions for all purposes during the 1960 calendar year are estimated at about 6,000 acre-feet, not including diversions of less than 10 acre-feet per year. Of this total about 700 acre-feet were for municipal or domestic purposes, 3,200 acre-feet were for irrigation or stockwatering, and 2,400 acre-feet were for industrial purposes.*

Local Needs and Possible Solutions

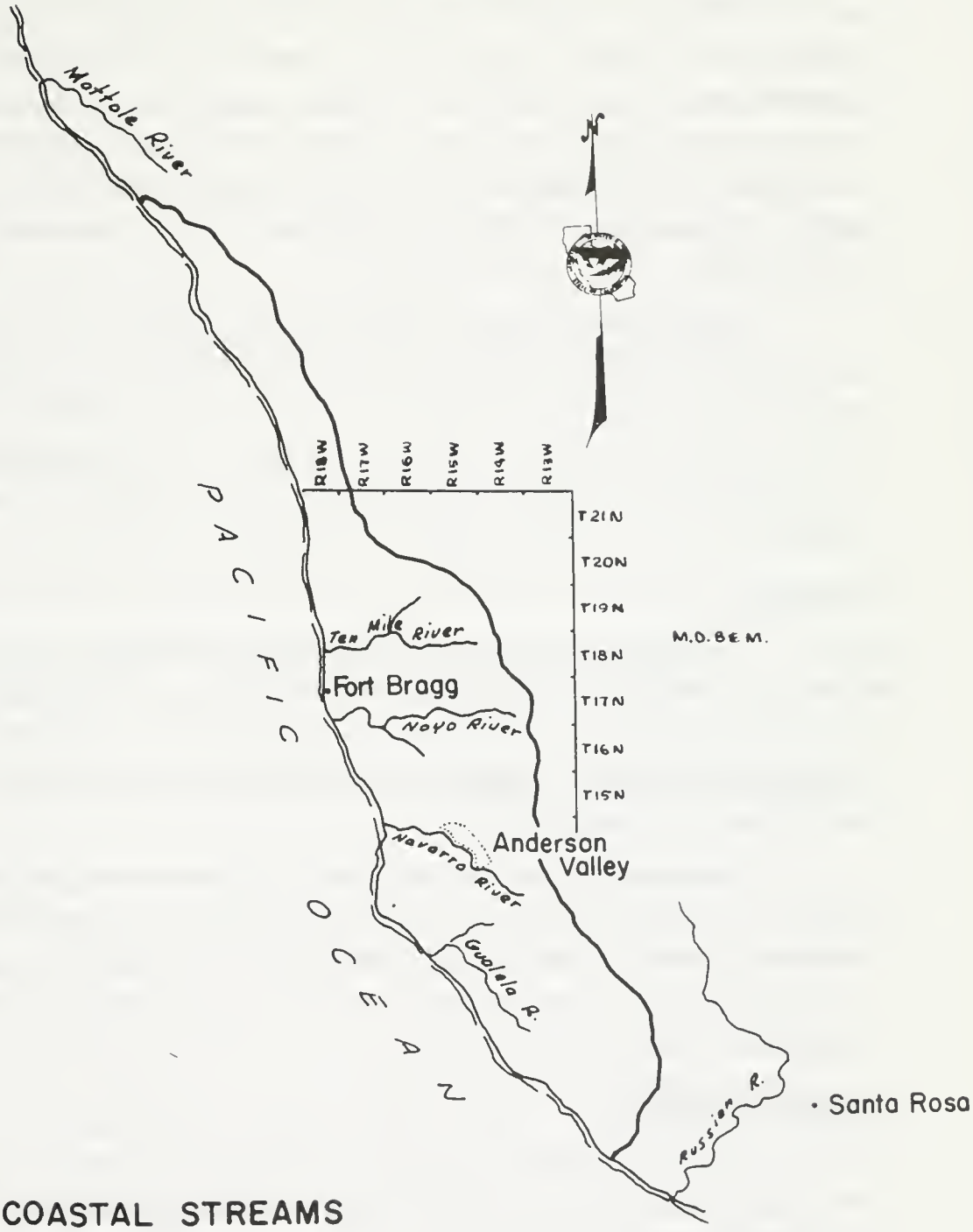
This section describes the local needs for water development and outlines possible projects to satisfy these needs. Figure 6 shows the Mendocino Coastal Stream study area.

Flood Control

At the present time there are no flood control works on any of the coastal streams on Mendocino County. Generally, the streams are all characterized by deep, narrow gorges with a limited amount of bottom land. These gorges have a confining influence on the streams and the communities are usually located on the broad terraces along the coast rather than on the streambanks.

* Figures taken from Department of Water Resources Bulletin No. 94-10, "Land and Water Use in Mendocino Coastal Streams Hydrographic Unit", and Bulletin No. 142-1, "Water Resources and Future Water Requirements, North Coastal Hydrographic Area".

Figure 6



MENDOCINO COASTAL STREAMS

Water Requirements

Population projections for the Mendocino Coastal area indicate that populations will more than double between 1960 and 1990 and nearly double again by 2020. In addition, a large pulp mill is projected for the Fort Bragg area by 1990, with a water requirement of 20,400 acre-feet in 1990 and 28,000 acre-feet in 2020. The resulting municipal and industrial water requirement projections increase spectacularly from about 2,000 acre-feet in 1960 to 25,300 acre-feet in 1990 and 38,400 acre-feet in 2020.

Irrigation acreages in the area are projected to increase from 2,100 acres in 1960 to 5,800 acres in 1990 and 15,600 acres in 2020. The corresponding irrigation requirements are 3,200 acre-feet in 1960, 8,500 acre-feet in 1990, and 23,100 acre-feet in 2020. Anderson Valley, in particular, will require an additional source of water in the near future.

Recreation

The Pacific Ocean is the key component of nearly all recreation activity in this area. Sightseers are attracted by the spectacular ocean and stream fisheries. However, the year-long low air and water temperatures and the coastal fog discourage the types of activities associated with beach areas in warmer climates.

At present there is very little inland recreational development. Reservoirs on the streams in the area would provide opportunities for water-associated recreation. The proximity of the Mendocino Coastal area to the population concentration of the San Francisco Bay area would insure heavy use of such facilities.

Fishery Enhancement

All the streams in the study area support salmon and steelhead runs. As is typical of the North Coast area, these fisheries suffer from high water temperatures and low flows during the summer. In some cases, poor logging practices have produced logjams and deposited silt in the streams.

Properly located water storage developments could provide higher summer flows and lower water temperatures on some of these streams. Reductions in flood flows would help prevent damage to spawning areas.

Enhancement of the small coastal streams could provide mitigation for damage to fisheries caused by major developments on the Eel, Trinity, Mad, Van Duzen, and Klamath Rivers. These major developments would inundate or block off a large part of the spawning and nursery areas of anadromous fish in the upper portions of these drainages. Plans for major development include on-site mitigation projects but in some cases on-site projects will not be sufficient. Off-site projects on the Mendocino coastal streams could compensate for the resulting damage to the fish resource.

Future Work Program

The possible future water development projects mentioned in this chapter included: (1) water supply developments for Fort Bragg and Anderson Valley, and (2) fishery enhancement and mitigation projects.

It is recommended that funds be provided to enable the Department of Water Resources to conduct the Fort Bragg--Anderson Valley Local Project Study and the Small Coastal Streams Fishery Enhancement Study.

The Department initiated the Fort Bragg--Anderson Valley Local Project Study in fiscal year 1966-67 with the expenditure of $20,000 from existing North Coastal Area Investigation funds. This first year of study consists of a preliminary examination of the Fort Bragg and Navarro River areas. Preliminary examinations will be made of possible projects to evaluate their suitability as water supplies for pulp mills in the vicinity of Fort Bragg or agricultural development in Anderson Valley. The preliminary examination will include collection and analysis of information on topography, geology, water supply, and water use. Consultations will be made with representatives of the Departments of Fish and Game and Parks and Recreation. One of the projects, for either Fort Bragg or the Anderson Valley area, will be selected for a reconnaissance study. A memorandum report will be prepared at the end of the preliminary examination detailing the scope, need, and scheduling of the selected reconnaissance study.

The reconnaissance study of the project selected would involve: (1) hydrology studies to determine flows in the Navarro River and to estimate the potential yield of the project; (2) analysis of the quality of the water supply and the water quality requirements; (3) refinement of water demand projections; (4) evaluation of fish and wildlife resources and recreation potential; and (5) geology and design studies.

The Small Coastal Streams Fishery Enhancement Study would consist of a preliminary examination of the hydrology, geology, and fisheries of the coastal streams north of San Francisco Bay. The results of this study would lead to the selection of a small coastal stream which would be used as a pilot project to determine means of improving the coastal fishery and in turn mitigate damages to coastal streams caused by other projects. A pilot project to accomplish this objective would require a ten- to twelve-year period.

The reconnaissance study resulting from the Fort Bragg--Anderson V lley Local Project Study would last about 24 months and cost about $80,000. The Small Coastal Streams Fishery Enhancement Study would also last about 24 months and cost about $60,000. If budgeted as a part of an overall North Coastal area study of local projects, as proposed in this report, both studies would begin in July 1967 and be completed in June 1969.

CHAPTER VII. FUTURE WORK PROGRAM

This report has identified areas of need for planning studies of local water development opportunities in the Smith, Mad, Van Duzen, and south Fork Eel River Basins, and in the Mendocino Coastal area. In addition to these areas which were treated in the preceeding chapters, there are other areas that should be studied - notably the Scott, Shasta and Butte Valleys in Siskiyou County. Through a brief review of problems involving water needs and resources that can be improved or enhanced by water project development in the North Coastal area, a proposed future work program has been laid out to determine the value of these projects. These studies to determine the engineering feasibility and economic justification are the first step in establishing an action program for construction of water projects that can help create a better economy for the North Coastal area.

It is proposed that studies be conducted to the level of completeness justified by the individual need and type of project proposed. Reports on the individual projects will be prepared and published as the studies are completed. This will enable district, county, state, and federal agencies to adopt plans for local project development and proceed to seek methods to finance and construct these needed local projects.

Mad River

As the largest population center in the North Coastal area the Eureka - Arcata - Humboldt Bay area has the greatest need for water supply development. To fulfill these needs in the expanding suburban and recreational area north of Arcata it is recommended that reconnaissance level studies be conducted to lay out and design a new water supply system for the McKinleyville to Big Lagoon area. Studies should also be initiated to determine the potential interim use of Ruth Reservoir from the time that the proposed Butler Valley Reservoir is built until export projects are constructed on the Mad River.

Smith River

The Crescent City--Smith River area in Del Norte County is an area of priority need for economic development. It is recommended that reconnaissance level studies be conducted to: (1) evaluate the possibility of constructing Rowdy Creek Reservoir to provide a new water supply to the Crescent City--Smith River Plain area; (2) define and evaluate possible small flood protection works for Crescent City; and (3) evaluate the possibility of developing water level controls and salt water barriers at Lake Earl and Lake Talawa to provide flood protection and create new Recreational opportunities.

South Fork Eel River

The South Fork Eel River Basin, served by U. S. Highway 101, "The Redwood Highway", has a great potential for recreational water development. Reconnaissance studies in progress will select two or three of the best projects to exploit the opportunity to create water surfaces and increased streamflow to meet the recreation demand of the nearby San Francisco Bay area. It is recommended that a feasibility level study be conducted to further evaluate the best project identified in these current planning studies.

Scott Valley

Although not identified in the legislative resolution that initiated this study and not treated in the preceeding chapters, this area has a good potential for increased utilization of its agricultural and recreational resources through development of water projects. It is recommended that a reconnaissance level study be conducted to evaluate the possibility of constructing Callahan Reservoir (DWR Bulletin No. 3) to provide for these future local water requirements and, possibly, to enhance king salmon runs in the area. The possibility of constructing an artificial king salmon spawning ground on the Scott River below Callahan damsite should be investigated.

Shasta Valley

This is also an area not identified in Assembly Concurrent Resolution No. 27 or treated in detail in the preceeding chapters. However, previous statewide water requirement studies indicate that

this area will have a large future need for water for agricultural uses. There is also a pressing need for development of new water supplies for the City of Yreka. The City is currently conducting studies to identify projects to satisfy its needs. It is recommended that additional reconnaissance level studies be conducted to develop a plan for action to meet these local water requirements. Additional conservation of local water is possible. Water needs could be met by pumping water from the Klamath River into Shasta Valley.

Butte Valley

Like the Scott and Shasta Valleys this area has not been treated in the preceeding chapters. Previous statewide water requirement studies indicated that this area will also have a large future growth in irrigation water requirements. The valley has recently been stimulated by construction of a surface drain from Meiss Lake to the Klamath River. This paves the way for increased use of water. Pumping from the Klamath River is a possible method of satisfying requirements for the large area of irrigable land. It is recommended that a reconnaissance level study be conducted to develop a plan to satisfy these future requirements.

Van Duzen River

Reservoir developments on the upper Van Duzen River could provide a source of future water requirements in the lower Van Duzen River Basin and in the Eel River Delta and at the same time enhance fish populations in the Van Duzen River. It is recommended that a reconnaissance level study be conducted to evaluate the possibility of constructing storage projects on the upper Van Duzen River.

Trinity County

Another study, that was not previously described, should be undertaken to evaluate the potential of a project to supply irrigation water to the Hayfork Valley in Trinity County. This project might also be used to enhance resident trout fisheries on Hayfork Creek and the upper South Fork Trinity River.

Mendocino Coastal Area

In 1966-67 the San Francisco Bay District initiated a reconnaissance level study to determine the relative needs for future water

supplies in the Anderson Valley and Fort Bragg areas. The District proposes to select one of these areas for detailed reconnaissance study in 1967-68 and 1968-69. It is recommended that this study be incorporated in this North Coastal area action program. This study will formulate a water development project to provide a water supply for the area selected.

Small Coastal Streams Fishery Enhancement

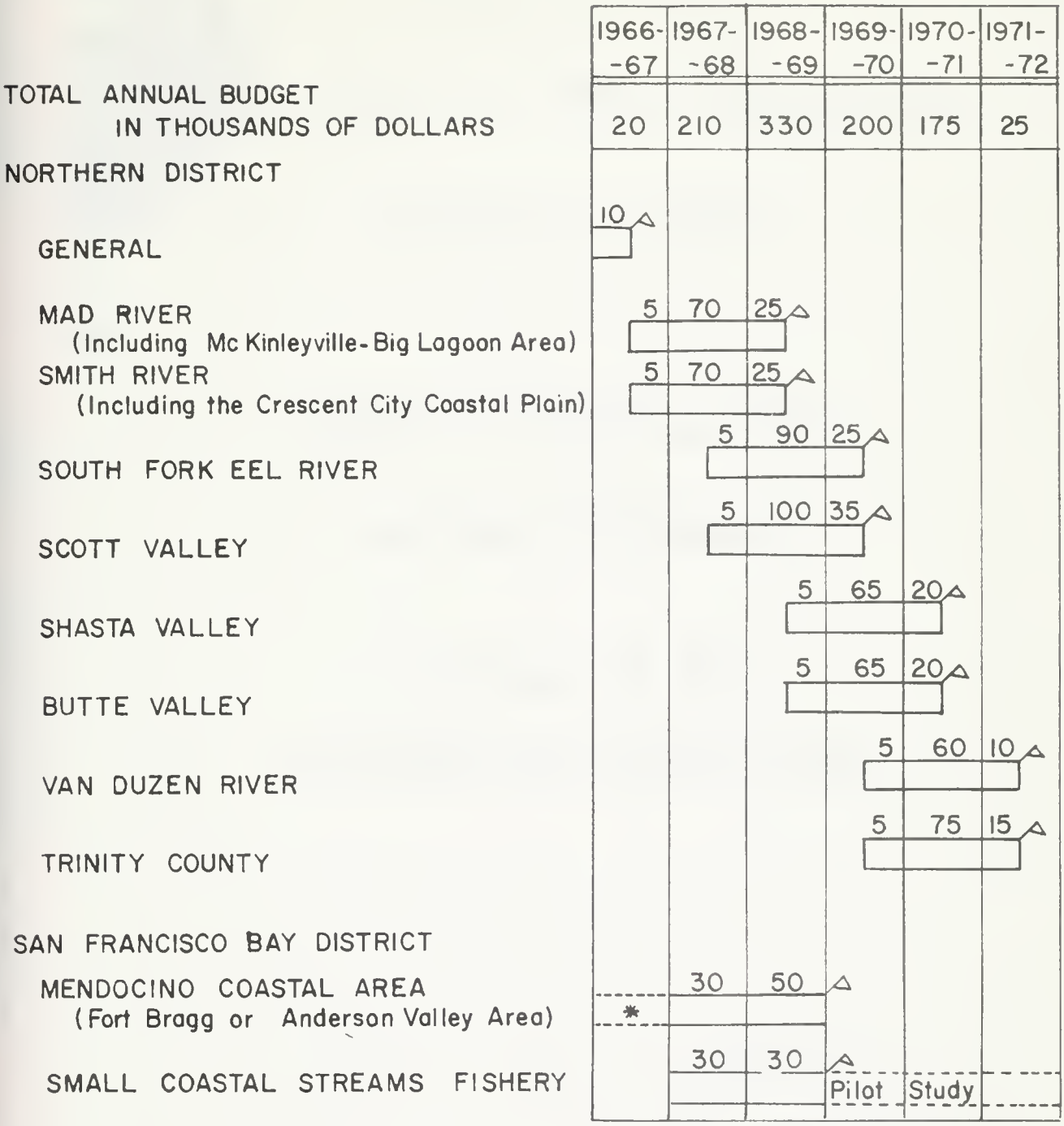
As future export projects are constructed on major streams in the North Coastal area the valuable anadromous fish populations of these streams will be drastically affected. In many cases it may not be possible to mitigate for fisheries losses at the location of the proposed future project. It is recommended that a study be conducted to explore the possibilities of establishing a pilot project to develop methods of improving small coastal streams to increase their anadromous fish populations.

Control Schedule

Figure 7 presents the proposed timing and cost of the studies outlined in detail in Chapter II through VI and the other studies identified in this chapter. It is recommended that these studies be set up as one program and budgeted at the annual levels shown in the top line of Figure 7. This would mean that these studies would be accelerated to an intensive level in 1967-68 and would continue at a high level through 1970-71.

The total planning study funds included in this six-year control schedule are $960,000, with $800,000 of this total allocated to programs in the Department's North District and $160,000 allocated to programs in the San Francisco Bay District.

All of the studies envisioned in Figure 7 would include work in the technical specialities of land and water use, hydrology, flood control, recreation, and fish and wildlife. Each of these studies would result in a formal report presenting the most desirable projects to satisfy local needs and complement the California Water Plan.



Report

*This program was initiated in 1966-67 by the expenditure of $20,000 from existing W. A. 1250, North Coastal Area Investigation

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